ELIMINATION OF *SITOPHILUS ORYZAE* IN RICE THROUGH DIFFERENTIAL DIELECTRIC HEATING

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June 2020

INTRODUCTION

Differential dielectric heating

The dielectric heating by radiofrequency (RF) and microwaves (MW) cause the rotation of the dipolar molecules in rice and rice weevil, and the electric energy is dissipated into heat as the result of this rotation.

The dielectric loss factor (e'') difference between rice and rice weevil enable to warm the insects without warming the rice. These methods are very interesting due their capability to destroy insects pests, without harming the environment nor reaching high temperatures for a long time, as opposed to current techniques.

Table 1 (top) and 2 (bottom). *These tables shows the differences in e'' between rice and rice weevil. Table 1 is from Ipsita* et al.*, 2013; table 2 is from Ibrahim* et al.*, 2019.*

Adult insect species	Frequency (GHz) 0.2 ε'	0.2 ε''	2.4 ε'	2.4 ε''	9.4 ε'	9.4 ε''
S. oryzae	28	12	17	3	17	3
L. decemlineata	53	81	38	12	30	16
S. oryzae	42	28	32	9	25	12
S. oryzae	55	48	42	13	31	16
T. castaneum	61	56	47	15	34	19
O. surinamensis	70	68	53	17	40	21
R. dominica	63	55	43	15	34	19

ε': dielectric constant, ε'': dielectric loss.

Average	Rice
\ε'	12.4547
ε"	1.6942
$tan\delta = \frac{\varepsilon''}{\varepsilon'}$	0.1360

AIMS

- Quantify *Sitophilus oryzae* reduction by RF and MW.
- Evaluate if these methods are a good alternative to the current ones.

METHODOLOGY

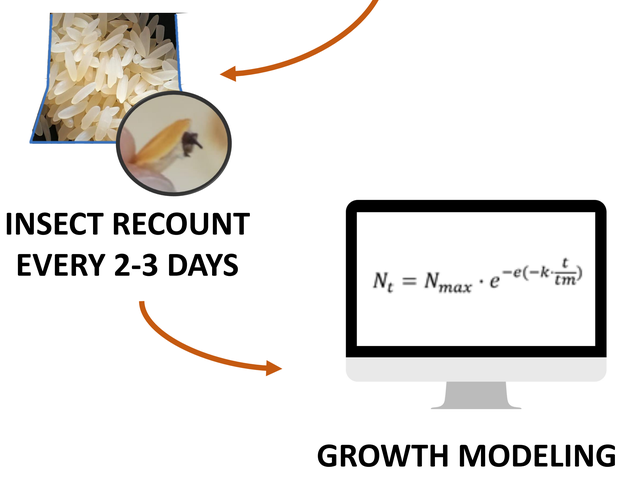
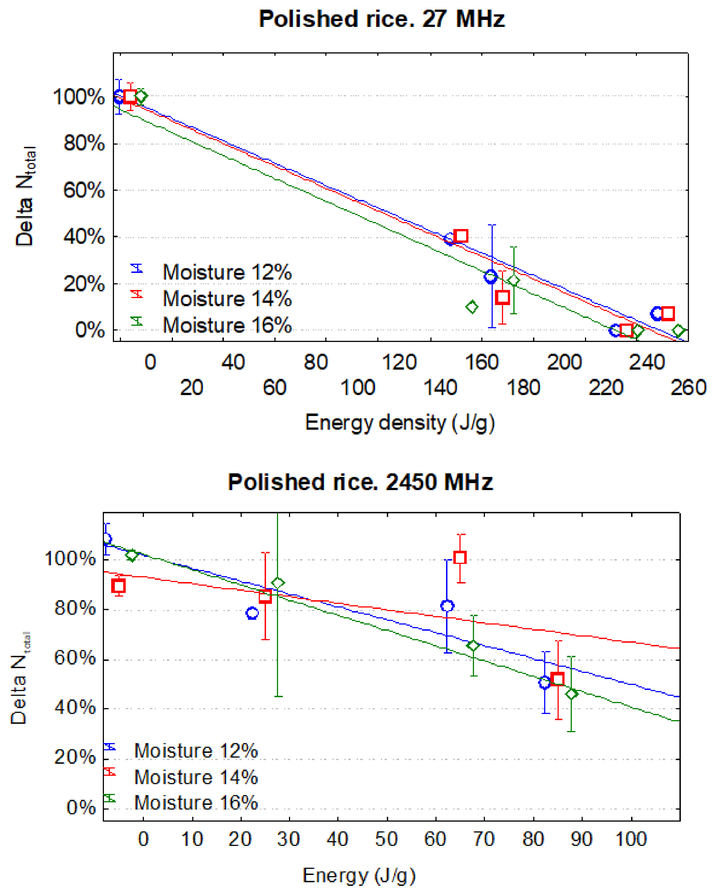


Figure 1. *Followed methodology outline to get the results. Treatment tunnel picture obtained from Duran, 2010.*

RESULTS



To halve the total insect number is needed an energy density (dE) around 100-115 J/g for RF, and around 100-130 J/g for MW.

An increase in the temperature has been seen with increasing dE and moisture.

So, depending on which treatment is used, the temperature increase can reach over 60 ºC and harm the rice quality.

Figure 2. *Insect reduction graphics for radiofrequency (top) and microwaves (bottom) treatments.*

CONCLUSIONS

- *Sithopilus oryzae* reduction has been quantified.
- No chemical residues are produced and the lethal temperatures for the insects are reached in less than five minutes. But temperatures which can modify the organoleptic quality of rice can also be reached.
- Therefore and because the high variability of the results, it is necessary to do more research with the aim of developing the desired treatment.

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ACNOWLEDGEMENTS:

This work is part of the Operational group on **Innovations in post-harvest treatments against weevils in rice** (ELMIRA), funded by Generalitat de Catalunya and EAFRD trough **Ayudas a la Cooperación para la Innovación** of PDR 2014-2020 (operation 16.01.01), working as Operational Group from the **European Innovation Partnership for Agricultural productivity and Sustainability** (EIP-AGRI).

Fons Europeu Agrícola de Desenvolupament Rural: Europa inverteix en les zones rurals

Generalitat de Catalunya
Departament d'Agricultura, Ramaderia, Pesca i Alimentació